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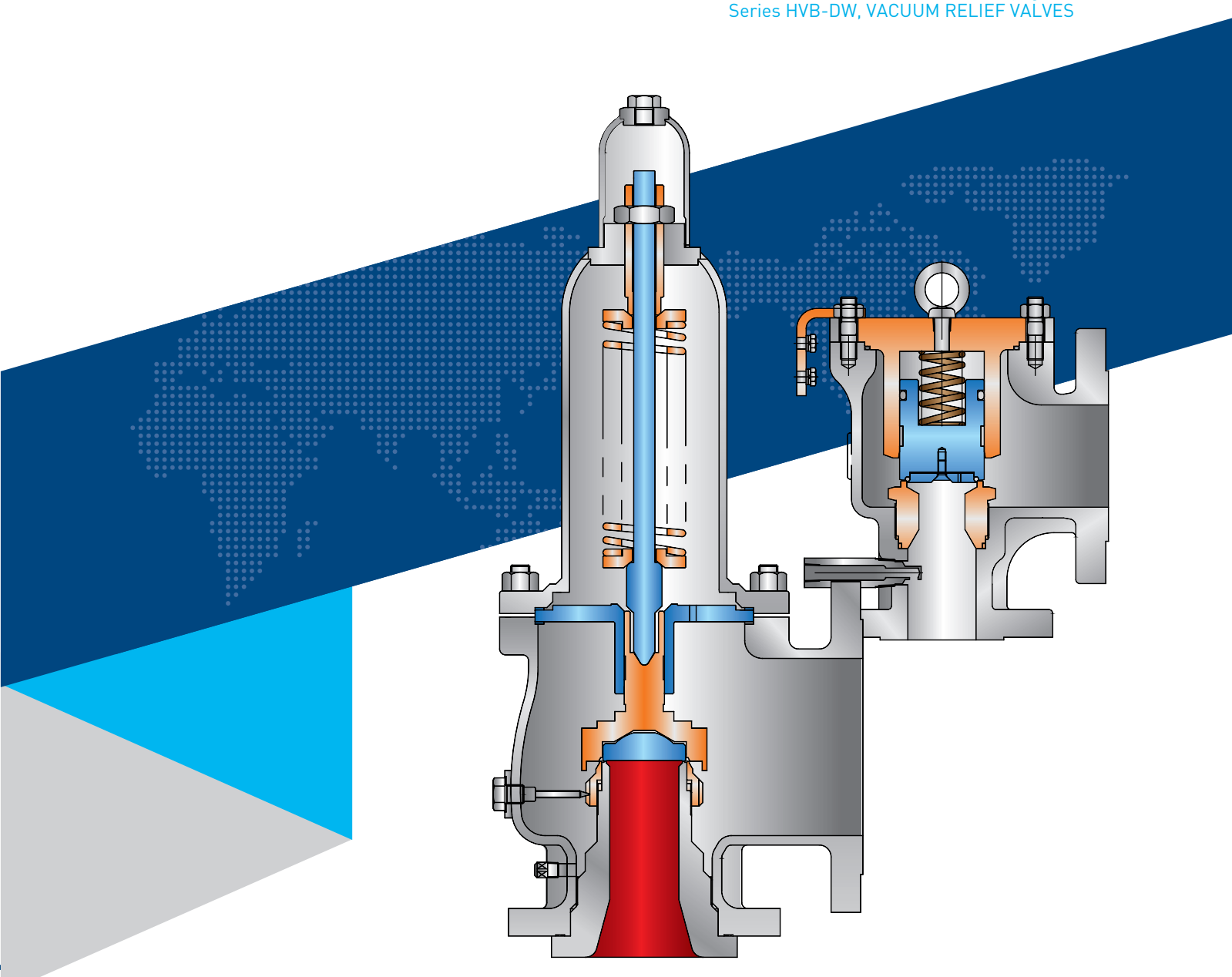
CR-CAT-201610-N01-1

SAFETY RELIEF VALVE

Series SC32, SPRING LOADED SAFETY RELIEF VALVES
Series SC39, SPRING LOADED SAFETY RELIEF VALVES
Series SP32, PILOT OPERATED SAFETY RELIEF VALVES
Cryogenic Services
Series HSF-FCA, SPRING LOADED SAFETY RELIEF VALVES for Cryogenic
Series HSP-OVT, PILOT OPERATED SAFETY RELIEF VALVES for Cryogenic
Series SP35, PILOT OPERATED SAFETY RELIEF VALVES for Cryogenic
Series HVB-DW, VACUUM RELIEF VALVES



Mt.H CONTROL VALVES CO.,LTD.

Well known and always reliable control valve company
helping to build a better system

Dear and Valuable Customers!

Mt.H has abundant experience and various achievements of safety relief valves and control valves for protection and safety in industrial plant projects and marine services and Mt.H also has consulted, provided, produced and supplied these valves to our customers with frontier spirit and business philosophy since 1978.
Therefore, we believe that these our efforts have contributed modern industry development and safety of each field including environment for human prosperity. Presently, We have faced with the various demand of industry, plants, environmental conservation, marine services, offshore gas facility, refining, natural gas, Petroleum Drilling and other chemical plants.
Mt.H has foreseen this situation and then set our policy to satisfy the needs of our customers. Mt.H has been developing its technology in cryogenic safety and control valves field. Mt.H's cryogenic pilot operated safety valve has been nominated as New Excellent Product for LNG/LPG service by KOREA Government on May 2011.
We believe our cryogenic valves offer sufficient satisfaction to our customers and all needed places with our policy.

- The best technique, product and service provided to customers.
- Offer the most reasonable price.
- Construct faith and cooperation between Mt.H and customers.
- Strong after sales service supports customers.

We can offer you with our best efforts.
Thanks a lot

E.S.Kang / Chairman Y.C.Kim / President

A Company History

APR.	1978	The company was established under the name of Halla Automatic Valves.
May.	1985	Concluded the license agreement with AKOGmbH in Germany.
OCT.	1988	First shipment of the valves for marine to Japan.
FEB.	1992	Awarded the prize for developing by Hyundai Heavy Industries Co., Ltd.
MAR.	1996	Awarded "A-Mark" for Quality Control Prize by Hyundai Heavy Industries Co., Ltd.
JAN.	1997	Type approved by the KR, ABS for the fabrication of valves. - Main Starting Valves - Crank Case Relief Valves
OCT.	1997	Awarded the medal for developing by Prime Minister. - Crank Case Relief Valve Trap
APR.	1998	Awarded the medal for small and medium business company's day by President.
AUG.	1999	Achieved ISO-9001 certificate.
NOV.	2001	Appointed as the small and medium enterprise of the innovated technology by the Small and Medium Business Administration.
APR.	2002	Moved factory from Sinpyong to Nok-San National Industrial Complex. And company name is changed from "Halla Automatic Valves Co., Ltd." to "Mt.H Control Valves Co., Ltd."
SEP.	2002	Achieved advanced ISO-9001/2000 certificate by Korea Accreditation Board
DEC.	2005	Established R&D center NO. 20052975
DEC.	2007	Achieved GTT Approval certificate (FRU/N 07-1167)
DEC.	2006	Registered Venture Company NO. 20060100999
NOV.	2010	Achieved Excellent Invention Certificate for Korea Invention Promotion Association
APR.	2011	Achieved New Excellent Product Certificate for Korea Agency for Technology and Standards Ministry of Knowledge Economy (Republic of Korea)
DEC.	2011	Registered in KOGAS as a major supplier for equipment(cryogenic pilot operated safety valves)
NOR.	2012	Export cryogenic pilot operated safety valves to the Middle East
MAR.	2013	Supply cryogenic pilot operated safety valves with vacuum breakers to samcheok LNG terminal.
FEB.	2014	Supply cryogenic pilot operated safety valves with vacuum breaker to samcheok LNG terminal.
SEP.	2015	Obtained of ASME UV stamp Certificate(Safety Relief Valves)

1. GENERAL INFORMATION

SC32 : Pressure Relief Valves, SP32 : Pilot Operated Safety Valves are low-cost valves realized by the technology, experience and know-how in designing and manufacturing Safety Valves that Mt.H Control Valves has accumulated and they therefore meet a variety of customer's need for Safety Pessure Relief. Futhermore, Safety Valves can handle various fluids incluiding air, gas, steam, vapor and liquid, thus finding wide and popular use in general plants, power generation plants, storage facilities and many other fields. They also boast of the "UV" stamp obtained from ASME(American Society of Mechanical Engineers).

2. DEFINITIONS

| Safety Valve |
A spring-loaded presssure-relief valve actuated by the static pressure upstream of the valve and characterized by rapid opening or pop action. A safety valve is normally used with compressible fluids.

| Relief Valve |
A spring-loaded presssure-relief valve actuated by the static pressure upstream of the valve. The valve opens normally in proportion to the pressure increase over the opening pressure. A relief valve is used primarily with incompressible fluids.

| Safety Relief Valve |
A spring-loaded presssure-relief valve that maybe used as either a safety or relief valve depending on the application.

| Conventional Pressure-Relief Valve |
A spring-loaded pressure-relief valve whose operational characteristics are directly affected by changes in the backpressure.

| Balanced Pressure-Relief Valve |
A spring-loaded pressure-relief valve that incorporates a bellows or other means for minimizing the effect of backpressure on the operational characteristics of the valve.

| Pilot-Operated Pressure-Relief Valve |
A pressure-relief valve in which the major relieving device or main valve is combined with and controlled by a self-actuated auxillary pressure-relief valve(pilot).

| Simmer |
The audible or visible escape of compressible fluid between the seat and disc of a pressure-relief valve that may occur at an inlet static pressure below the set pressure prior to opening.

| Set Pressure |
The inlet gauge pressure at which the pressure-relief device is set to open under service conditions.

| Overpressure |
The pressure increase over the set pressure of the relieving device. Overpressure is expressed in pressure units or as a percentage of set pressure.

| Opening Pressure |
The value of increasing inlet static pressure at which there is a measurable lift of the disc or at which discharge of the fluid becomes continuous, as determined by seeing, feeling or hearing.

| Relieving Conditions |
The inlet pressure and temperature on a pressure-relief device during an overpressure condition. The relieving pressure is equal to the valve set pressure plus the over pressure. The temperature of the flowing fluid at relieving conditions may be high or lower than the operating temperature.

| Superimposed Backpressure |
The static pressure that exists at the outlet of a pressure-relief device at the time the device is required to operate. Superimposed backpressure is the result of pressure in the discharge system coming from other sources and maybe constant or variable.

| Built-up Back Pressure |
The increase in pressure at the outlet of a pressure-relief device that develops a result of flow after the pressure-relief device opens.

| Blowdown |
The difference between the set pressure and the closing pressure of a pressure-relief valve, expressed as a percentage of the set pressure or in pressure units.

3. FEATURE AND ADVANTAGES
- Improved disc insert for easy maintenance
- Full compliance with ASME boiler and pressure vessel code section VIII and API standard 526 and 527
- The Capacity is certified by the National Board of Boiler and Pressure Vessel Inspectors
- Designed to function equally well on air, gases, steam or liquid services

4. APPLICATION OF INTERNATIONAL CODE
- ASME pressure vessel code, Section VIII, Division 1
- API RP 520 - Sizing, Selection and Installation of Pressure-Relief Device in Refineries
- API RP 526 - Flanged Steel Pressure Relief Valves
- API RP 527 - Seat Tightness of Pressure Relief Valves
- ASME B16.34 - Valve-flanged, Threaded and Welding End

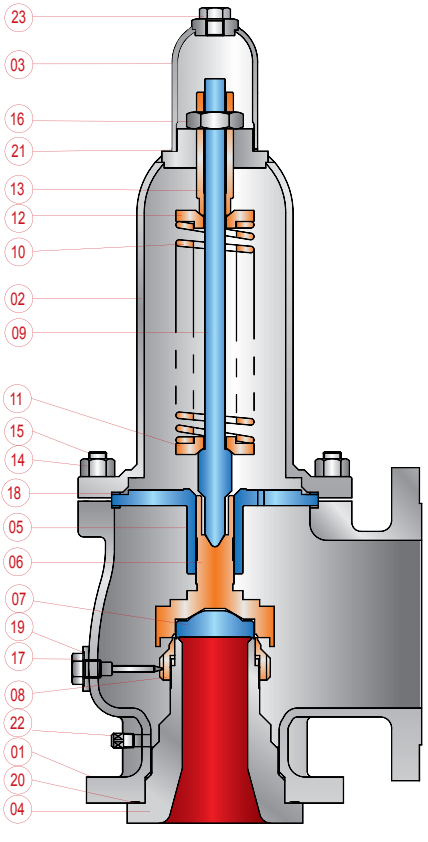
5. SPECIFICATIONS

Description	SC32 series, Technical Specification	SP32 series, Technical Specification
Pressure Range, psi(bar)	15 ~ 6000psi (1 ~ 413bar)	15 ~ 10000psi (1 ~ 689bar)
Size (inch)	3/4 x 1 " to 20 x 24"	1 x 2 " to 20 x 24"
Orifice	D to Z1	D to B

UV

6. CONSTRUCTION

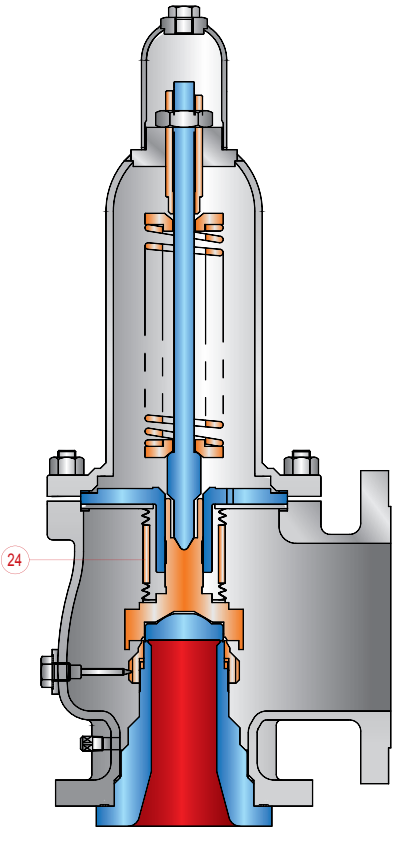
[6.1 SC32 series]



<Conventional Pressure-Relief Valve>

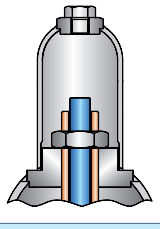
no.	Part Name	Material
1	Body	Carbon Steel Stainless Steel
2	Bonnet (casting/welded)	Carbon Steel Stainless Steel
3	Cap (casting/welded)	Carbon Steel Stainless Steel
4	Seat(Nozzle)	Stainless steel
5	Guide	Stainless steel
6	Holder	Stainless steel
7	Disc	Stainless steel
8	Adjust Ring	Stainless steel
9	Stem	Stainless steel
10	Spring	Chrome Alloy High Temp. Alloy Steel Stainless steel
11	Low Spring Seat	Stainless steel
12	Upper Spring Seat	Stainless steel
13	Adjust Screw	Stainless steel
14	Nut	Stainless steel
15	Stud Bolt	Stainless steel
16	Lock Nut	Stainless steel
17	Set Screw	Stainless steel
18	Gasket	Non-Asbestos PTFE
19	Gasket	Non-Asbestos PTFE
20	Gasket	Non-Asbestos PTFE
21	Gasket	Non-Asbestos PTFE
22	Drain Plug	Stainless steel
23	Plug	Stainless steel
24	Bellows	Stainless steel

Other material can be supplied

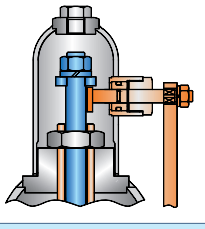


<Balanced Pressure-Relief Valve>

[Caps & Lifting Levers]



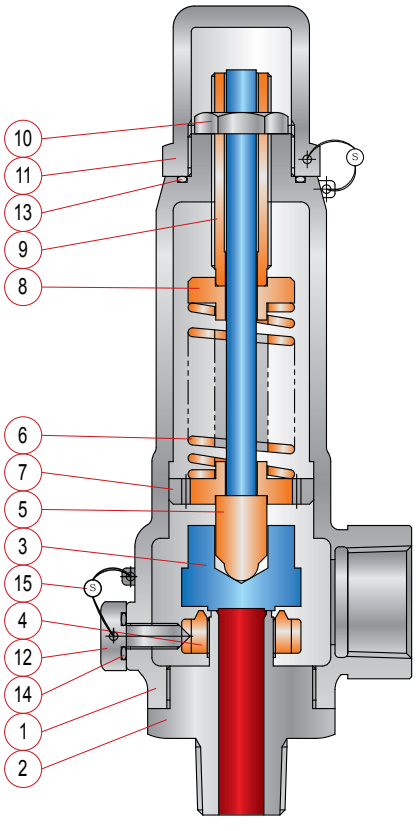
<Screw Cap>		
Application	close cap	sour gas



<Packed Lever>		
Application	close cap	sour gas

ASME UV

[6.2 SC39 series]
Threaded Safety Relief Valve



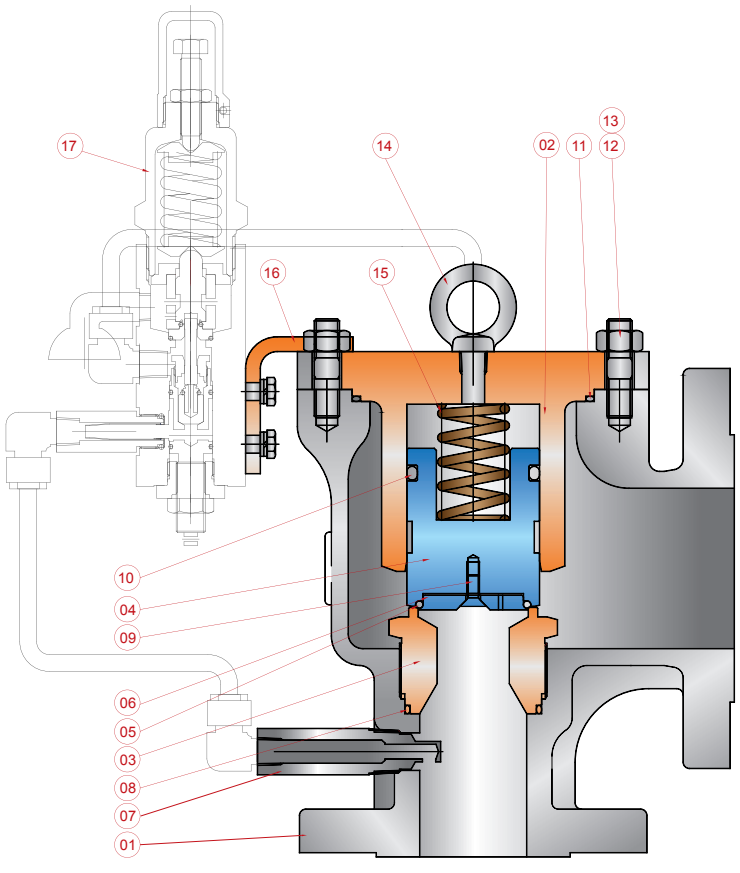
no.	Part Name	Material
1	Body (casting/welding)	Carbon Steel Stainless Steel Copper Alloy
2	Nozzle	Stainless steel
3	Disc	Stainless steel
4	Control Ring	Stainless steel
5	Stem	Stainless steel
6	Spring	Chrome Alloy High Temp. Alloy Steel Stainless steel
7	Low Spring Seat	Stainless steel
8	Upper Spring Seat	Stainless steel
9	Adjust Screw	Stainless steel
10	Lock Nut	Stainless steel
11	Cap	Carbon Steel Stainless steel Copper Alloy
12	Set Screw	Stainless steel
13	Seal	Soft Goods
14	Seal	Soft Goods

∗ Other material can be supplied

- **Simple Design of Snap Acting Performance**
  Design minimizes the number of components with pop performance
- **Available with Soft Seat**
  Main valve soft seat is easily maintained and repaired. Fully seat tightness
- **Adjustable blowdown**
  Blowdown is readily controlled by adjusting control ring
- **Full Open and Lift**
  When the valve is operating at overpressure, the rated capacity is discharged to downstream
- **Applicable Temperature and Pressure Range**
  -196℃ ~ + 200℃ / ~ 400bar
- **The end connection Condition**
  Standard connection Inlet / Outlet : MPT / FPT. Other various connections thread and type is available
- **Integral Nozzle/ Inlet Bushing**
  Threaded convertible nozzles can be removed and replaced easily when nozzle is needed for new

[6.3 SP32 series]
Main Valve

UV



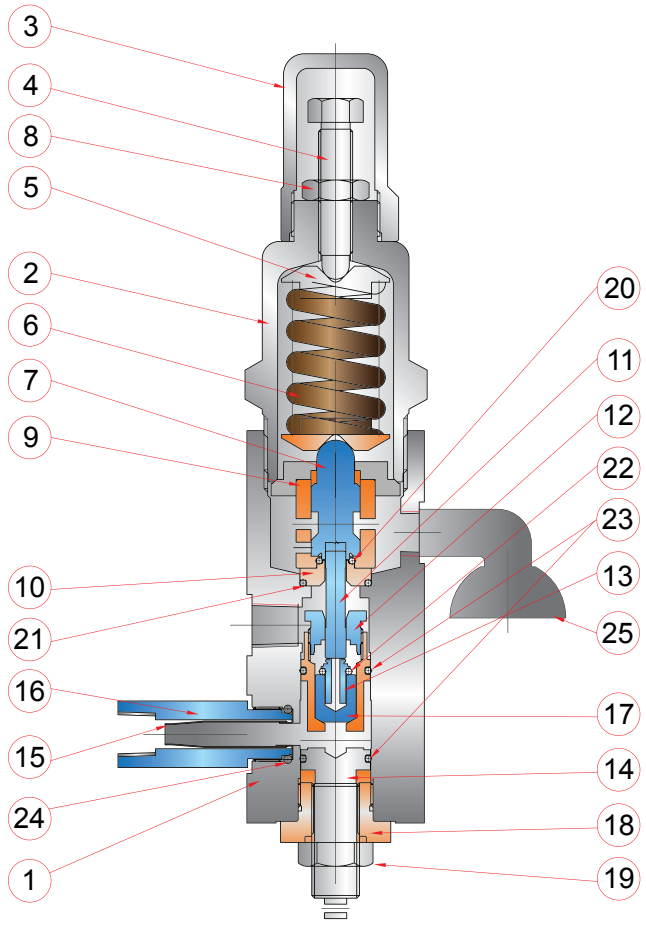
no.	Part Name	Material
1	Body	SA 216-WCB SA 351-CF8M
2	Guide/Cover	SA 351-CF8M
3	Nozzle	Stainless steel
4	Piston	Stainless steel
5	Seat Seal	Soft Goods
6	Seat Retainer	Stainless steel
7	Pick-up Pressure	Stainless steel
8	Nozzle Seal	Soft Goods
9	Seat Screw	SA 193-B8M
10	Piston Seal	Soft Goods
11	Seal	Soft Goods
12	Stud Bolt	Stainless steel
13	Nut	SA 194-8M
14	Eye Bolt	SA 193-B8M
15	Return Spring	Stainless steel
16	Bracket	Stainless steel
17	Pilot Valve	Stainless steel

∗ Other material can be supplied

- **Simple Design of Main Valve**
  Design minimizes the number of components and maximizes their interchangeablility
- **Main Valve Soft Seat**
  Main valve soft seat is easily maintained and repaired. Fully seat tightness
- **Main Valve Metal to Metal Seat Design**
  Provides main valve disc high performance in high temperature service
- **Full Open and Lift**
  When the valve is operating at overpressure, the rated capacity is discharged to downstream
- **Balanced Design**
  Lift not affected by back pressure, no expensive and fragile bellows required to balance against high back pressure
- **Stainless Steel Trim**
  This trim is standard and included nozzle, piston, retainer and guide for prevent corrosion
- **Interchangeable Nozzle**
  Threaded convertible nozzles can be removed and replaced easily when nozzle is needed for new
- **Simple Internal Components**
  The valve design requires no lift stopper and main valve opens fully at set pressure. It is not need for additional parts to restrict lift.
- **Snap Acting & Modulating Common Use**
  Main valve component can be used with snap acting pilot valve or with modulating pilot valve for the various services.

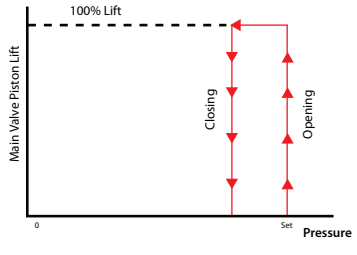
UV

[6.4 SP32 series]
Snap Acting Pilot Valve



no.	Part Name	Material
1	Body	SA 351-CF8M
2	Bonnet	Stainless steel
3	Cap	Stainless steel
4	Adjust Screw	Stainless steel
5	Spring Bottom	Stainless steel
6	Spring	Stainless steel
7	Disc	Stainless steel
8	Jam Nut	Stainless steel
9	Guide	Stainless steel
10	Upper Seat	Stainless steel
11	Blow Down Relay	Stainless steel
12	Lower Seat	Stainless steel
13	Retainer	Stainless steel
14	Blow Down Adjust	Stainless steel
15	Filter	Stainless steel
16	Filter Housing	Stainless steel
17	Poppet	Stainless steel
18	Cap	Stainless steel
19	Nut	Stainless steel
20	Upper Seat Seal	Soft Goods
21	Static Seal, Body	Soft Goods
22	Seal	Soft Goods
23	Seal	Soft Goods
24	Seal	Soft Goods
25	Vent	SB-211, GR2024

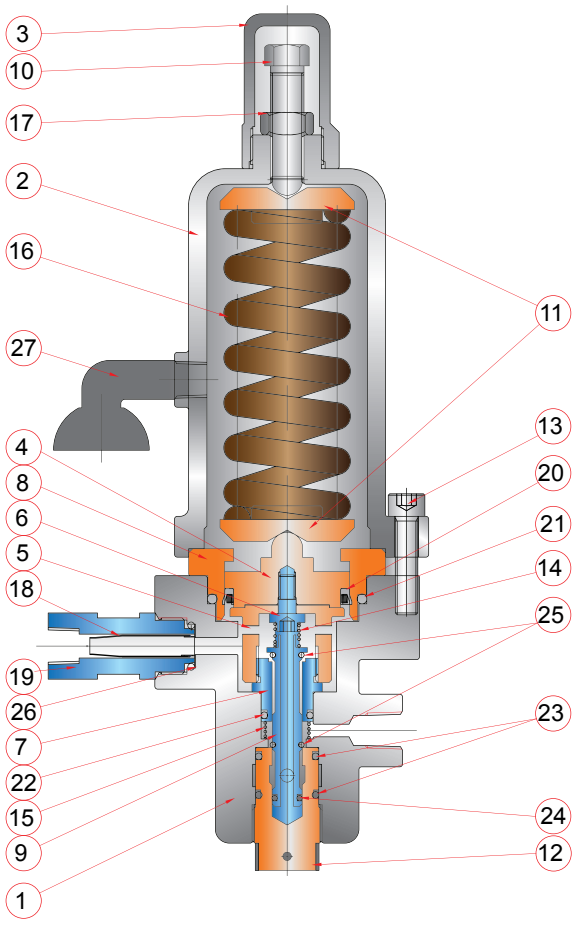
- **Flow of Process Media :** Non-flowing Pilot
- **Position :** Vertical pilot mounting
- **Blowdown :** Adjustable
  A adjustable blowdown pilot control with external adjustment. blowdown adjustment 7%
- **Stainless Steel Construction :** Resist corrosion and extends the long life
- **Soft Seats and Seals :** Chemical resistant seal and seats enhance a control's life
- **Field Test Capable :** Use of a field test connection allows cycling the pilot valve without interrupting system protection or removing the valve from the line. It can be check the set pressure in the field.
- **Remote Sensing Capable :** When there is excessive inlet piping losses, or when the main valve must be installed at a different location on the protected system because of its service limitations, the pilot sensing line can be installed separate from main valve
- **Ease of Set Pressure Adjustment :** Adjustment for set pressure allows accurate and dependable setting
- **Valve Operating Characteristics :** When the pressure is reached at the set pressure, disc is lifted up quickly and then the compressed media is discharged to downsteam



- **Application Service :** Fluids : Air, Gas, Vapor

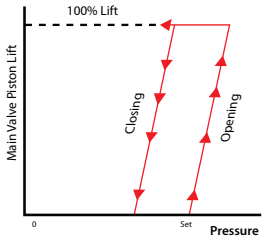
[6.5 SP32 series]
Modulating Pilot Valve

UV



no.	Part Name	Material
1	Body	SA 351-CF8M
2	Bonnet	SA 351-CF8M
3	Cap	Stainless steel
4	Piston	Stainless steel
5	Retainer	Stainless steel
6	Retainer Screw	Stainless steel
7	Inlet Seat	Stainless steel
8	Guide	Stainless steel
9	Spool	Stainless steel
10	Adjust Screw	Stainless steel
11	Spring Buttons	Stainless steel
12	Spool Cap	Stainless steel
13	Bonnet Wrench Bolt	Stainless steel
14	Spool Return Spring	Stainless steel
15	Lower Return Spring	Stainless steel
16	Spring	Stainless steel
17	Jam Nut	Stainless steel
18	Filter	Stainless steel
19	Filter House	Stainless steel
20	Energized Seal	PTFE +HC
21	Guide seal	Soft Goods
22	Body Seal	Soft Goods
23	Spool Cap Seal	Soft Goods
24	Spool Seal	Soft Goods
25	Seat Seal	Soft Goods
26	Filter Seal	Soft Goods
27	Vent	SB-211, GR2024

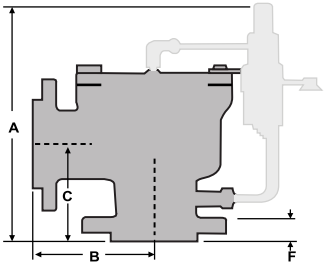
- **Flow of Process Media :** Non-flowing Pilot
- **Position :** Vertical pilot mounting
- **Blowdown :** Fixed
  a fixed blowdown pilot control with no external adjustment
- **Stainless Steel Construction :** Resist corrosion and extends the long life
- **Soft Seats and Seals :** Chemical resistant seal and seats enhance a control's life
- **Field Test Capable :** Use of a field test connection allows cycling the pilot valve without interrupting system protection or removing the valve from the line. It can be check the set pressure in the field.
- **Remote Sensing Capable :** When there is excessive inlet piping losses, or when the main valve must be installed at a different location on the protected system because of its service limitations, the pilot sensing line can be installed separate from main valve
- **Ease of Set Pressure Adjustment :** Adjustment for set pressure allows accurate and dependable setting
- **Valve Operating Characteristics :** When the pressure is reached at the set pressure, disc is lifted proportionally depend on the required flow and/or inlet pressure changes (increase or decrease). Valve disc open and close slowly. So it is perferred to minimum loss of media.



- **Application Service :** Fluids : Air, Gas, Vapor, Liquid

7. VALVE SELECTION

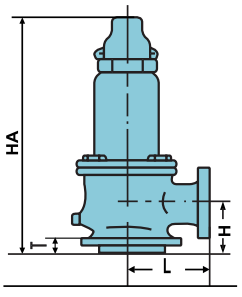
[Orifice, Size, Dimension and Weight for SP32 series]



Size	Orifice	ANSI flange		Dimension (mm)				Approx. Weight(kg)
		inlet	outlet	B	C	F	A	
1 x 2	D, E, F	150	150	115	105	18	321	16
		300		115	112	24	328	17
		600		115	112	24	328	17
		900	300	121	126	37	340	23
		1500		121	126	37	340	23
		2500		121	126	43	343	25
1.5 x 2	D, E, F, G, H	150	150	121	124	29	356	22
		300		121	124	29	356	23
		600		121	124	29	356	23
		900	300	140	150	40	381	33
		1500		140	150	40	381	33
		2500		140	150	54	385	39
1.5 x 3	G, H	150	150	124	131	31	356	23
		300		124	131	31	356	24
		600		124	131	31	356	24
		900	300	172	162	40	388	35
		1500		172	162	40	388	35
		2500		172	162	54	390	44
2 x 3	G, H, J	150	150	124	137	32	381	30
		300		124	137	32	381	30
		600		124	137	32	381	30
		900	300	172	167	48	410	47
		1500		172	167	48	410	47
		2500		172	178	61	426	55
3 x 4	J, K, L, M	150	150	162	156	32	448	62
		300		162	156	32	448	64
		600		162	162	39	455	64
		900	300	181	191	58	486	89
		1500		181	191	58	486	93
4 x 6	L, M, N, P	150	150	210	197	45	515	97
		300		210	197	45	515	99
		600		210	197	45	515	100
		900	300	234	250	64	559	146
		1500		234	250	64	559	148
6 x 8	Q, R	150	150	242	240	48	625	211
		300		242	240	48	625	218
		600		242	247	54	630	227
8 x 10	T	150	150	280	277	42	730	377
		300		280	277	42	730	379
		600		280	297	62	730	420

7. VALVE SELECTION

[Orifice, Size, Dimension and Weight for SC32 series]

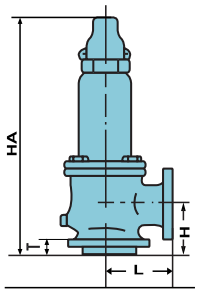


Orifice	Size	ANSI flange		Dimension (mm)				Approx. Weight(kg)
		inlet	outlet	L	H	T	HA	
D	3/4 x 1	150	150	96	88	26	359	9
	3/4 x 1 *	300	150	96	88	26	359	9
	3/4 x 1	300	150	96	88	26	359	9
	1 x 2	150	150	115	105	31	367	11
	1 x 2 *	300	150	115	105	31	367	11
	1 x 2	300	150	115	105	31	367	11
	1 x 2	600	150	115	105	31	483	13
	1.5 x 2	900	300	140	105	51	597	20
	1.5 x 2	1500	300	140	105	51	597	20
	1.5 x 3	2500	300	178	140	63.5	597	23
E	1 x 2	150	150	115	105	31	367	11
	1 x 2 *	300	150	115	105	31	367	12
	1 x 2	300	150	115	105	31	367	12
	1 x 2	600	150	115	105	31	483	14
	1.5 x 2	900	300	140	105	51	597	20
	1.5 x 2	1500	300	140	105	51	597	20
	1.5 x 3	2500	300	178	140	63.5	597	23
F	1.5 x 2	150	150	121	124	35	391	15
	1.5 X 2 *	300	150	121	124	38	391	15
	1.5 x 2	300	150	153	124	38	391	15
	1.5 x 2	600	150	153	124	41	585	17
	1.5 x 3	900	300	166	124	51	597	27
	1.5 x 3	1500	300	166	124	51	597	27
	1.5 x 3	2500	300	178	140	63.5	597	35
G	1.5 x 3	150	150	121	124	35	468	17
	1.5 X 3 *	300	150	121	124	38	468	17
	1.5 x 3	300	150	153	124	38	468	19
	1.5 x 3	600	150	153	124	41	597	21
	1.5 x 3	900	300	166	124	51	597	29
	2 x 3	1500	300	172	156	57	610	37
	2 x 3	2500	300	172	156	70	610	42
H	1.5 x 3	150	150	124	131	35	468	17
	1.5 X 3 *	300	150	124	131	38	468	20
	2 x 3	300	150	124	131	40	468	22
	2 x 3	600	150	162	154	44.5	610	25
	2 x 3	900	150	162	154	57	610	42
	2 x 3	1500	300	162	154	57	610	45
J	2 x 3	150	150	124	137	36.5	493	23
	2 X 3 *	300	150	124	137	40	493	24
	3 x 4	300	150	181	185	46	493	44
	3 x 4	600	150	181	185	51	724	50
	3 x 4	900	150	181	185	57	915	59
	3 x 4	1500	300	181	185	66.7	915	77

* : Set pressure limited for low pressure application

7. VALVE SELECTION

[Orifice, Size, Dimension and Weight for SC32 series]



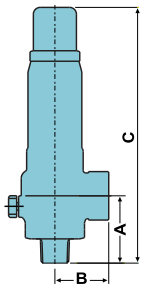
Orifice	Size	ANSI flange		Dimension (mm)				Approx. Weight(kg)
		inlet	outlet	L	H	T	HA	
K	3 x 4	150	150	162	156	41.3	674	41
	3 X 4 *	300	150	162	156	46	674	43
	3 x 4	300	150	162	156	46	724	47
	3 x 4	600	150	181	185	51	902	57
	3 x 6	900	150	216	199	57	953	80
	3 x 6	1500	300	216	197	66.7	953	95
L	3 x 4	150	150	166	156	41.3	674	52
	3 X 4 *	300	150	166	156	46	674	54
	4 x 6	300	150	181	180	49.2	978	72
	4 x 6	600	150	204	180	57	978	77
	4 x 6	900	150	223	197	63.5	1093	108
	4 x 6	1500	150	223	197	72	1097	117
M	4 x 6	150	150	185	178	41.3	801	58
	4 X 6 *	300	150	185	178	49.2	801	72
	4 x 6	300	150	185	178	49.2	978	90
	4 x 6	600	150	204	178	57	1093	110
	4 x 6	900	150	223	197	63.5	1093	120
N	4 x 6	150	150	210	197	41.3	801	76
	4 X 6 *	300	150	210	197	49.2	801	81
	4 x 6	300	150	210	197	49.2	978	105
	4 x 6	600	150	223	197	57	1093	113
	4 x 6	900	150	223	197	63.5	1093	125
P	4 x 6	150	150	229	181	41.3	801	83
	4 X 6 *	300	150	229	181	49.2	801	110
	4 x 6	300	150	254	226	49.2	978	147
	4 x 6	600	150	254	226	57	1093	142
	4 x 6	900	150	254	226	63.5	1093	171
Q	6 x 8	150	150	242	240	45.9	1029	160
	6 X 8 *	300	150	242	240	57	1029	170
	6 x 8	300	150	242	240	57	1143	195
	6 x 8	600	150	242	240	69.7	1296	250
R	6 x 8	150	150	242	240	45.9	1029	220
	6 X 8 *	300	150	242	240	57	1029	230
	6 x 10	300	150	267	240	57	1143	250
	6 x 10	600	150	267	240	69.7	1296	260
T	8 x 10	150	150	280	277	49	1245	245
	8 X 10 *	300	150	280	277	61.7	1245	300
	8 x 10	300	150	280	277	61.7	1245	300

* : Set pressure limited for low pressure application

7. VALVE SELECTION

[Size, Orifice, Dimension and Weight for SC39 series]

Thread Connection		Orifice	Dimension (mm)			Approx. Weight(kg)
inlet	outlet		B	A	C (max)	
1/2"	3/4"	C	45	50	190	2
3/4"	1"	C, D, E	52	58	205	6
1"	1"	C, D, E	52	62	210	6.3
1.5"	2"	F, G, H	85	70	305	10
2	3	H	100	80	330	15



* Various inlet/ outlet connections (thread and type) is available.

• Effective area each of the orifices for SC39 series is follows.

orifice symbol	unit	C	D	E	F	G	H
Actual area (SC39)	mm²	31.6	71.0	126.5	198.1	324.5	506.5
	inch²	0.049	0.11	0.196	0.307	0.503	0.785
API area	mm²	-	71.0	126.5	198.1	324.5	506.5
	inch²	-	0.11	0.196	0.307	0.503	0.785

8. SIZING

<API 520>

Fluid	SI units	USC units	Remark
Gas or Vapor	$A = \frac{W}{CK_dP_1K_bK_c}\sqrt{\frac{TZ}{M}}$	$A = \frac{W}{CK_dP_1K_bK_c}\sqrt{\frac{TZ}{M}}$	Critical flow
Steam	$A = \frac{190.5\times W}{P_1K_dK_bK_cK_NK_{SH}}$	$A = \frac{W}{51.5\times P_1K_dK_bK_cK_NK_{SH}}$	
Liquid	$A = \frac{11.78\times Q}{K_dK_wK_cK_v}\sqrt{\frac{G_l}{P_1-P_2}}$	$A = \frac{Q}{38\times K_dK_wK_cK_v}\sqrt{\frac{G_l}{P_1-P_2}}$	

A = required orifice area, mm^2 (in^2)
W = relieving capacity, kg/hr (lb/hr) for Gas or Steam
Q = relieving capacity, L/min (gal/min) for Liquid
C = coefficient determined from an expression of the ratio of the specific heats of gas or vapor

$C = 0.03948\sqrt{k\left(\frac{2}{k+1}\right)^{\frac{(k+1)}{(k-1)}}}$ in SI unit

k = ratio of the specific heats, (C_p/C_v)
K_d = coefficient of discharge by actual test
K_w = capacity correction factor due to back pressure
G_1 = the specific gravity of the liquid at the flowing temperature at standard conditions
K_v = the correction factor due to viscosity
K_{SH} = superheat correction factor
saturated steam factor = 1.0

P_1 = upstream relieving pressure, kPaa (psia) for Gas or Steam : set pressure+overpressure+atmospheric pressure
P_1 = upstream relieving pressure, kPag (psig) for Liquid : set pressure plus overpressure
P_2 = total backpressure, kPag (psig)
K_b = capacity correction factor due to back pressure
K_c = combination correction factor for installation
T = relieving temperature of the inlet gas or vapor, K 273+℃ (460+℉)
Z = compressibility factor
M = molecular weight of the gas or vapor, kg/kg-mole (lbm/lb-mole)
K_b = capacity correction factor due to back pressure
K_N = correction factor for the Napier equation
= 1.0 for P1 ≤ 10,339 kPaa

$= \frac{0.02764\times P_1-1000}{0.03324\times P_1-1061}$ for 10,339kPaa<P1 ≤22,057 kPaa

9. ORIFICE EFFECTIVE AREA OF SAFETY VALVE

[Effective area each of the orifices for SC32, SP32 series is follows.]

orifice symbol	unit	D	E	F	G	H	J	K
Actual area (SC32 series)	mm^2	88.2	181.4	243.2	383.3	594.0	961.7	1372.1
	$inch^2$	0.1368	0.2812	0.3772	0.5945	0.9212	1.491	2.128
Actual area (SP32 series)	mm^2	96.8	145.2	239.0	360.6	563.2	923.2	1316.8
	$inch^2$	0.15	0.225	0.371	0.559	0.873	1.431	2.041
API area	mm^2	71.0	126.5	198.1	324.5	506.5	830.3	1185.8
	$inch^2$	0.11	0.196	0.307	0.503	0.785	1.287	1.838

orifice symbol	unit	L	M	N	P	Q	R	T
Actual area (SC32 series)	mm^2	2138.8	2686.1	3264.8	4533.8	8409.9	10201.0	18135.1
	$inch^2$	3.317	4.165	5.063	7.027	13.042	15.811	28.109
Actual area (SP32 series)	mm^2	2045.2	2581.3	3111.6	4572.2	7914.2	10207.1	18145.8
	$inch^2$	3.17	4.001	4.823	7.087	12.267	15.821	28.126
API area	mm^2	1840.6	2322.6	2800.0	4116.1	7129.0	10322.6	16774.2
	$inch^2$	2.853	3.6	4.34	6.38	11.05	16.0	26.0

• Actual area is applied when using the measured nominal coefficient of discharge.
• API area : Effective area of orifice specified in the API 526 standard orifice.
Using an actual area of orifice to determine the relieving capacity of valve is allowed under API 520 part1, section 5.2.4

10. CAPACITY TABLE

[SC32 series] ASME Pressure Vessel Code(UV), SI Metric Units, [m^3/h], Air Capacity

Set Pressure (barg)	Orifice Letter Designation & Area, mm^2													
Areas	D	E	F	G	H	J	K	L	M	N	P	Q	R	T
API	71.0	126.5	198.1	324.5	506.5	830.3	1185.8	1840.6	2322.6	2800.0	4116.1	7129.0	10322.6	16774.2
Actual	88.2	181.4	243.2	383.3	594.0	961.7	1372.1	2138.8	2686.1	3264.8	4533.8	8409.9	10201.0	18135.1
1	105	216	290	457	708	1146	1635	2549	3202	3891	5404	10024	12159	21616
2	160	329	441	695	1077	1743	2487	3876	4868	5917	8217	15242	18488	32868
3	215	441	592	933	1445	2340	3338	5204	6535	7943	11030	20461	24818	44121
4	269	554	743	1170	1814	2936	4190	6531	8202	9969	13844	25679	31148	55374
5	324	666	893	1408	2182	3533	5041	7858	9868	11995	16657	30897	37477	66627
6	379	779	1044	1646	2551	4130	5892	9185	11535	14020	19470	36115	43807	77879
7	433	892	1195	1884	2919	4727	6744	10512	13202	16046	22283	41334	50137	89132
8	488	1004	1346	2122	3288	5323	7595	11839	14869	18072	25096	46552	56467	100385
9	543	1117	1497	2360	3657	5920	8446	13166	16535	20098	27910	51770	62796	111638
10	598	1229	1648	2597	4025	6517	9298	14493	18202	22124	30723	56989	69126	122890
12	707	1454	1950	3073	4762	7710	11001	17148	21535	26175	36349	67425	81785	145396
14	817	1679	2252	3549	5499	8904	12703	19802	24869	30227	41976	77862	94445	167901
16	926	1905	2553	4024	6237	10097	14406	22456	28202	34278	47602	88299	107104	190407
18	1035	2130	2855	4500	6974	11291	16109	25110	31536	38330	53228	98735	119763	212912
20	1145	2355	3157	4976	7711	12484	17812	27765	34869	42381	58855	109172	132423	235418
22	1254	2580	3459	5451	8448	13678	19514	30419	38203	46433	64481	119608	145082	
24	1364	2805	3761	5927	9185	14871	21217	33073	41536	50485	70108	130045	157741	
26	1473	3030	4062	6403	9922	16065	22920	35727	44869	54536	75734	140482	170401	
28	1583	3255	4364	6878	10660	17258	24623	38381	48203	58588	81360	150918	183060	
30	1692	3480	4666	7354	11397	18451	26326	41036	51536	62639	86987	161355	195720	
32	1802	3706	4968	7830	12134	19645	28028	43690	54870	66691	92613	171792	208379	
34	1911	3931	5270	8305	12871	20838	29731	46344	58203	70743	98240	182228	221038	
36	2021	4156	5572	8781	13608	22032	31434	48998	61537	74794	103866	192665	233698	
38	2130	4381	5873	9257	14345	23225	33137	51653	64870	78846	109493	203101	246357	
40	2240	4606	6175	9732	15082	24419	34839	54307	68203	82897	115119	213538	259016	
42	2349	4831	6477	10208	15820	25612	36542	56961	71537	86949	120745			
44	2458	5056	6779	10684	16557	26806	38245	59615	74870	91001	126372			
46	2568	5281	7081	11159	17294	27999	39948	62270	78204	95052	131998			
48	2677	5506	7382	11635	18031	29193	41650	64924	81537	99104	137625			
50	2787	5732	7684	12111	18768	30386	43353	67578	84871	103155	143251			
60	3334	6857	9193	14489	22454	36353	51867	80849	101538	123413	171383			
70	3881	7983	10702	16868	26140	42321	60381	94120	118205	143671	199515			
80	4429	9108	12211	19246	29825	48288	68895	107392	134872	163929	227647			
90	4976	10234	13720	21624	33511	54255	77409	120663	151539	184187	255779			
100	5523	11359	15229	24003	37197	60223	85922	133934	168206	204445	283911			
110	6070	12485	16738	26381	40883	66190	94436	147205						
120	6618	13611	18248	28759	44568	72157	102950	160476						
130	7165	14736	19757	31138	48254	78125	111464	173747						
140	7712	15862	21266	33516	51940	84092	119978							
150	8260	16987	22775	35894	55626	90059	128491							
160	8807	18113	24284	38273	59311	96027	137005							
170	9354	19239	25793	40651	62997	101994	145519							
180	9901	20364	27302	43030	66683	107961								
190	10449	21490	28811	45408	70369	113928								
200	10996	22615	30320	47786	74054	119896								
210	11543	23741	31829	50165										
220	12091	24866	33338	52543										
230	12638	25992	34847	54921										
240	13185	27118	36356	57300										
250	13732	28243	37865											
260	14280	29369	39374											
270	14827	30494	40883											
280	15374	31620	42392											
290	15921	32745	43901											
300	16469	33871	45410											
310	17016	34997	46919											
320	17563	36122	48428											
330	18111	37248	49938											
340	18658	38373	51447											
350	19205	39499												
360	19752	40625												
370	20300	41750												
380	20847	42876												
390	21394	44001												
400	21942	45127												
410	22489	46252												

1. Capacity Certified by National Board and Pressure Vessel Inspectors and in accordance with the ASME Boiler Pressure Vessel Code, Section VIII
2. Capacity in standard cubic meters per hour of air at 15.6℃ and at 10% overpressure.
3. The Larger orifice and size more than T orifice also shall be supplied.

10. CAPACITY TABLE

[SC32 series] ASME Pressure Vessel Code(UV), SI Metric Units, [kg/h], Steam Capacity

Set Pressure (barg)	Orifice Letter Designation & Area, mm^2													
Areas	D	E	F	G	H	J	K	L	M	N	P	Q	R	T
API	71.0	126.5	198.1	324.5	506.5	830.3	1185.8	1840.6	2322.6	2800.0	4116.1	7129.0	10322.6	16774.2
Actual	88.2	181.4	243.2	383.3	594.0	961.7	1372.1	2138.8	2686.1	3264.8	4533.8	8409.9	10201.0	18135.1
1	83	171	230	362	594	908	1,295	2,019	2535	3082	4280	7938	9629	17118
2	127	260	349	550	853	1380	1969	3070	3855	4686	6507	12071	14642	26029
3	170	350	469	739	1144	1853	2644	4121	5175	6290	8735	16203	19654	34941
4	213	439	588	927	1436	2325	3318	5172	6495	7895	10963	20336	24667	43852
5	257	528	708	1115	1728	2778	3992	6223	7815	9499	13191	24468	29680	52764
6	300	617	827	1304	2020	3271	4666	7274	9135	11103	15419	28601	34692	61675
7	343	706	947	1492	2312	3743	5341	8325	10455	12707	17647	32734	39705	70587
8	387	795	1066	1680	2604	4216	6015	9376	11775	14312	19875	36866	44718	79498
9	430	884	1186	1869	2896	4688	6689	10427	13095	15916	22102	40999	49730	88409
10	473	973	1305	2057	3188	5161	7363	11478	14415	17520	24330	45131	54743	97321
12	560	1152	1544	2434	3771	6106	8712	13590	17055	20729	28786	53396	64768	115144
14	647	1330	1783	2810	4355	7051	10060	15682	19694	23938	33242	61661	74794	132967
16	733	1508	2022	3187	4939	7996	11409	17784	22334	27146	37698	69926	84819	150789
18	820	1687	2261	3564	5523	8941	12757	19886	24974	30355	42153	78192	94844	168612
20	907	1865	2500	3940	6107	9887	14106	21988	27614	33563	46609	86457	104870	186435
22	993	2043	2739	4317	6690	10832	15454	24090	30254	36772	51065	94722	114895	
24	1080	2221	2978	4694	7274	11777	16803	26192	32894	39980	55521	102987	124921	
26	1167	2400	3217	5071	7858	12722	18151	28294	35534	43189	59976	111252	134946	
28	1253	2578	3456	5447	8442	13667	19500	30396	38173	46398	64432	119517	144971	
30	1340	2756	3695	5824	9025	14612	20848	32497	40813	49606	68888	127782	154997	
32	1427	2935	3934	6201	9609	15557	22197	34599	43453	52815	73343	136047	165022	
34	1513	3113	4173	6577	10193	16503	23545	36701	46093	56023	77799	144312	175047	
36	1600	3291	4412	6954	10777	17448	24893	38803	48733	59232	82255	152577	185073	
38	1687	3469	4651	7331	11360	18313	26242	40905	51373	62441	86711	160843	195098	
40	1774	3648	4890	7707	11944	19338	27590	43007	54013	65649	91166	169108	205123	
42	1860	3826	5129	8084	12528	20283	28939	45109	56652	68858	95622			
44	1947	4004	5368	8461	13112	21228	30287	47211	59292	72666	100078			
46	2034	4182	5607	8838	13696	22173	31636	49313	61932	75275	104534			
48	2120	4361	5846	9214	14279	23119	32984	51415	64572	78484	108989			
50	2207	4539	6085	9591	14863	24064	34333	53517	67212	81692	113445			
60	2640	5430	7280	11474	17782	28789	21075	64027	80411	97735	135724			
70	3074	6322	8475	13358	20701	33515	47818	74537	93610	113778	158002			
80	3507	7213	9671	15241	23620	38241	54560	85047	106810	129821				
90	3941	8105	10866	17125	26539	42967	61302	95557	120009	145864				
100	4381	9011	12081	19041	29507	47773	68159	106246	133433	162180				
110	4861	9998	13494	21126	32738	53004	75623	117880						
120	5355	11014	14766	23272	36064	58389	83306	129856						
130	5866	12064	16174	25491	39503	63957	91250	142239						
140	6396	13155	17637	27798	43078	69744								
150	6952	14297	19168	30211	46817	75799								
160	7537	15501	20783	32755	50760	82182								
170	8160	16783	22501	35463	54757	88976								
180	8831	18164	24352	38380										
190	9565	19673	26375	41569										
200	10383	21354	28629	45122										

1. Capacity Certified by National Board and Pressure Vessel Inspectors and in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII
2. Capacity in kilograms per hour of saturated steam at 10% overpressure.
3. The Larger orifice and size more than T orifice also shall be supplied.

10. CAPACITY TABLE

[SC32 series] ASME Pressure Vessel Code(UV), SI Metric Units, [L/min.] , Water Capacity

Set Pressure (barg)	Orifice Letter Designation & Area, mm^2													
Areas	D	E	F	G	H	J	K	L	M	N	P	Q	R	T
API	71.0	126.5	198.1	324.5	506.5	830.3	1185.8	1840.6	2322.6	2800.0	4116.1	7129.0	10322.6	16774.2
Actual	88.2	181.4	243.2	383.3	594.0	961.7	1372.1	2138.8	2686.1	3264.8	4533.8	8409.9	10201.0	18135.1
1	52	107	144	227	352	570	813	1,267	1591	1933	2685	4980	6041	10739
2	74	152	204	321	497	805	1149	1791	2250	2734	3797	7043	8543	15188
3	90	186	249	393	609	986	1407	2194	2755	3349	4650	8626	10463	18601
4	104	215	288	454	704	1139	1625	2533	3181	3867	5370	9960	12082	21479
5	117	240	322	508	787	1273	1817	2832	3557	4323	6004	11136	13508	24014
6	128	263	353	556	862	1395	1990	3102	3896	4736	6577	12199	14797	26306
7	138	284	381	601	931	1507	2150	3351	4209	5115	7103	13176	15983	28414
8	148	304	407	642	995	1611	2298	3582	4499	5468	7594	14086	17086	30376
9	157	322	432	681	1055	1709	2438	3800	4772	5800	8055	14941	18123	32218
10	165	340	455	718	1112	1801	2569	4005	5030	6114	8490	15749	19103	33961
12	181	372	499	786	1219	1973	2815	4388	5510	6697	9301	17252	20926	37202
14	195	402	539	849	1316	2131	3040	4739	5952	7234	10046	18634	22603	40183
16	209	430	576	908	1407	2278	3250	5066	6363	7738	10739	19921	24164	42958
18	222	456	611	963	1492	2416	3447	5374	6749	8203	11391	21129	25629	45563
20	234	480	644	1015	1573	2547	3634	5664	7114	8646	12007	22272	27016	48028
22	245	504	676	1065	1650	2671	3811	5941	7461	9068	12593	23359	28334	
24	256	526	706	1112	1723	2790	3981	6205	7793	9472	13153	24398	29594	
26	266	548	734	1157	1794	2904	4143	6458	8111	9858	13690	25394	30803	
28	276	568	762	1201	1861	3014	4300	6702	8417	10230	14207	26353	31965	
30	286	588	789	1243	1927	3119	4450	6937	8712	10590	14706	27278	33087	
32	295	608	815	1284	1990	3222	4596	7165	8998	10937	15188	28172	34173	
34	305	626	840	1324	2051	3321	4738	7385	9275	11273	15655	29040	35224	
36	313	645	864	1362	2111	3417	4875	7599	9544	11600	16109	29881	36245	
38	322	662	888	1399	2168	3511	5009	7808	9806	11918	16551	30700	37239	
40	330	679	911	1436	2225	3602	5139	8010	10060	12228	16981	31498	38206	
42	338	696	933	1471	2286	3691	5266	8208	10309	12530	17400			
44	346	713	955	1506	2333	3778	5390	8401	10551	12825	17809			
46	354	729	977	1539	2386	3863	5511	8590	10788	13113	18210			
48	362	744	998	1573	2437	3946	5629	8775	11021	13395	18601			
50	369	760	1018	1605	2487	4027	5746	8956	11248	13671	18985			
60	405	832	1116	1758	2725	4411	6294	9811	12321	14976	20797			
70	437	899	1205	1899	2943	4765	6798	10597	13309	16176	22463			
80	467	961	1288	2030	3146	5094	7268	11329	14227	17293	24014			
90	496	1019	1366	2153	3337	5403	7708	12016	15090	18342	25471			
100	522	1074	1440	2270	3578	5695	8125	12666	15907	19334	26849			
110	548	1127	1510	2381	3689	5973	8522	13284						
120	572	1177	1578	2487	3853	6239	8901	13875						
130	596	1225	1642	2588	4011	6493	9264	14441						
140	618	1271	1704	2686	4162	6738	9614							
150	640	1316	1764	2780	4308	6975	9952							
160	661	1359	1822	2871	4449	7204	10278							
170	681	1401	1878	2960	4586	7425	10594							
180	701	1441	1932	3045	4719	7641								
190	720	1481	1985	3129	4849	7850								
200	739	1519	2037	3210	4975	8054								
210	757	1557	2087	3289										
220	775	1593	2136	3367										
230	792	1629	2184	3442										
240	809	1664	2231	3516										
250	826	1699	2277											
260	842	1732	2322											
270	858	1765	2366											
280	874	1798	2410											
290	889	1829	2453											
300	905	1861	2494											
310	920	1891	2536											
320	934	1922	2576											
330	949	1951	2616											
340	963	1981	2656											
350	977	2010												
360	991	2038												
370	1005	2066												
380	1018	2094												
390	1031	2121												
400	1045	2148												
410	1058	2175												

1. Capacity Certified by National Board and Pressure Vessel Inspectors and in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII
2. Capacity in liters per minute of water at 20℃ and at 10% overpressure.
3. The Larger orifice and size more than T orifice also shall be supplied.

10. CAPACITY TABLE

[SP32 series] ASME Pressure Vessel Code(UV), SI Metric Units, [m^3/h], Air Capacity

Set Pressure (barg)	Orifice Letter Designation & Area, mm^2													
Areas	D	E	F	G	H	J	K	L	M	N	P	Q	R	T
API	71.0	126.5	198.1	324.5	506.5	830.3	1185.8	1840.6	2322.6	2800.0	4116.1	7129.0	10322.6	16774.2
Actual	96.8	145.2	239.0	360.6	563.2	923.2	1316.8	2045.2	2581.3	3111.6	4572.2	7914.2	10207.1	18145.8
1	118	177	291	439	685	1124	1603	2489	3142	3787	5565	9633	12423	22086
2	179	269	442	667	1042	1709	2437	3785	4717	5759	8462	14647	18891	33583
3	240	361	594	896	1399	2294	3271	5081	6413	7730	11359	19662	25358	45081
4	302	453	745	1124	1756	2879	4106	6377	8048	9702	14256	24676	31826	56578
5	363	545	897	1353	2113	3463	4940	7673	9684	11674	17153	29691	38293	68076
6	424	637	1048	1581	2470	4048	5774	8969	11320	13645	20050	34706	44760	79574
7	480	729	1200	1810	2827	4633	6609	10265	12955	15617	22947	39720	51228	91071
8	547	821	1351	2038	3183	5218	7443	11560	14591	17588	25844	44735	57695	102569
9	608	913	1502	2267	3540	5803	8278	12856	16226	19560	28741	49749	64163	114066
10	670	1005	1654	2495	3897	6388	9112	14152	17862	21531	31638	54764	70630	125564
12	792	1189	1957	2952	4611	7558	10781	16744	21133	25475	37432	64793	83565	148559
14	915	1373	2260	3409	5325	8728	12449	19336	24404	29418	43226	74822	96500	171554
16	1038	1557	2562	3866	6038	9898	14118	21927	27675	33361	49021	84852	109435	194549
18	1161	1741	2865	4323	6752	11068	15787	24519	30946	37304	54815	94881	122370	217544
20	1283	1925	3168	4780	7466	12238	17455	27111	34218	41247	60609	104910	135305	240539
22	1406	2109	3471	5237	8179	13408	19124	29703	37489	45190	66403	114939	148239	263534
24	1529	2293	3774	5694	8893	14578	20793	32295	40760	49133	72197	124968	161174	286530
26	1651	2477	4077	6151	9607	15748	22462	34886	44031	53077	77991	134998	174109	309525
28	1774	2661	4380	6608	10321	16918	24130	37478	47302	57020	83785	145027	187044	332520
30	1897	2845	4683	7065	11034	18087	25799	40070	50573	60963	89579	155056	199979	355515
32	2019	3029	4985	7522	11748	19257	27468	42662	53844	64906	95373	165085	212914	378510
34	2142	3213	5288	7979	12462	20427	29136	45253	57115	68849	101167	175114	225849	401505
36	2265	3397	5591	8436	13175	21597	30805	47845	60387	72792	106961	185144	238783	424500
38	2387	3581	5894	8893	13889	22767	32474	50437	63658	76735	112755	195173	251718	447495
40	2510	3765	6197	9350	14603	23937	34142	53029	66929	80679	118550	205202	2264653	470490
42	2633	3949	6500	9807	15317	25107	35811	55620	70200	84622	124344	215231	277588	493486
44	2755	4133	6803	10264	16030	26277	37480	58212	73471	88565	130138	225260	290523	516481
46	2878	4317	7105	10721	16744	27447	39149	60804	76742	92508	135932	235290	303458	539476
48	3001	4501	7408	11178	17458	28617	40817	63396	80013	96451	141726	245319	316393	562471
50	3123	4685	7711	11635	18171	29787	42486	65987	83284	100394	147520	255348	329327	585466
60	3737	5605	9226	13919	21740	35636	50829	78946	99640	120110	176490	305494	394002	700442
70	4350	6525	10740	16204	25308	41486	59173	91905	115996	139826	205461	355640	458676	815417
80	4963	7445	12254	18489	28877	47335	67517	104864	132351	159542	234431	405786	523350	930393
90	5577	8365	13769	20774	32446	53185	75860	117823	148707	179257	263402	455932	588025	1045368
100	6190	9285	15283	23059	36014	59035	84204	130782	165063	198973	292372	506078	652699	1160344
110	6803	10205	16797	25344	39583	64884	92547	143740	181418	218689	321342			
120	7417	11125	18312	27628	43151	70734	100891	156699	197774	238405	350313			
130	8030	12045	19826	29913	46720	76583	109234	169658	214130	258120	379283			
140	8643	12965	21340	32198	50288	82433	117578	182617	230485	277836	408254			
150	9257	13885	22855	34483	53857	88282	125921	195576	246841	297552	437224			
160	9870	14805	24369	36768	57425	94132	134265	208534	263197	317268	466194			
170	10483	15725	25883	39053	60994	99982	142608	221493	279552	336983	495165			
180	11097	16645	27398	41337	64563	105831	150952	234452	295908	356699				
190	11710	17565	28912	43622	68131	111681	159295	247411	312264	376415				
200	12323	18485	30427	45907	71700	117530	167639	260370	328619	396130				
210	12937	19405	31941	48192	75268	123380	175982	273328	344975					
220	13550	20325	33455	50477	78837	129230	184326	286287	361331					
230	14163	21245	34970	52762	82405	135079	192669	299246	377686					
240	14777	22165	36484	55046	85974	140929	201013	312205	394042					
250	15390	23085	37998	57331	89542	146778	209356	325164	410398					
260	16003	24005	39513	59616	93111	152628	217700	338122	426753					
270	16617	24925	41027	61901	96680	158478	226043	351081	443109					
280	17230	25845	42541	64186	100248	164327	234387							
290	17843	26765	44056	66471	103817	170177	242730							
300	18457	27685	45570	68756	107385	176026	251074							
310	19070	28605	47084	71040	110954	181876	259417							
320	19684	29525	48599	73325	114522	187725	267761							
330	20297	30445	50113	75610	118091	193575	276104							
340	20910	31365	51627	77895	121659	199425	284448							
350	21524	32285	53142	80180	125228	205274								
360	22137	33205	54656	82465	128797	211124								
370	22750	34125	56171	84749	132365	216973								
380	23364	35045	57685	87034	135934	222823								
390	23977	35965	59191	89319	139502	228673								
400	24590	36885	60714	91604	143071	234522								
410	25204	37805	62228	93889	146639	240372								

1. Capacity Certified by National Board and Pressure Vessel Inspectors and in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII
2. Capacity in standard cubic meters per hour of air at 15.6℃ and at 10% overpressure.
3. The Larger orifice and size more than T orifice also shall be supplied.

10. CAPACITY TABLE

[SP32 series] ASME Pressure Vessel Code(UV), SI Metric Units, [L/min.], Water Capacity

Set Pressure (barg)	Orifice Letter Designation & Area, mm^2													
Areas	D	E	F	G	H	J	K	L	M	N	P	Q	R	T
API	71.0	126.5	198.1	324.5	506.5	830.3	1185.8	1840.6	2322.6	2800.0	4116.1	7129.0	10322.6	16774.2
Actual	96.8	145.2	239.0	360.6	563.2	923.2	1316.8	2045.2	2581.3	3111.6	4572.2	7914.2	10207.1	18145.8
1	71	107	175	265	413	678	966	1501	1894	2284	3356	5808	7491	13317
2	100	151	248	374	585	958	1367	2123	2679	3230	4745	8214	10594	18833
3	123	185	304	458	716	1174	1674	2600	3281	3955	5812	10060	12975	23066
4	142	213	351	529	827	1355	1933	3002	3789	4567	6711	11616	14982	26634
5	159	238	392	592	924	1515	2161	3356	4236	5106	7503	12988	16750	29778
6	174	261	430	648	1012	1660	2367	3677	4640	5594	8219	14227	18349	32620
7	188	282	464	700	1094	1793	2557	3971	5012	6042	8878	15367	19819	35234
8	201	301	496	749	1169	1916	2733	4245	5358	6459	9491	16428	21188	37667
9	213	320	526	794	1240	2033	2899	4503	5683	6851	10067	17425	22473	39952
10	225	337	555	837	1307	2143	3056	4746	5991	7221	10611	18367	23689	42113
12	246	369	608	917	1432	2347	3348	5200	6562	7911	11624	20120	25950	46132
14	266	399	656	990	1547	2535	3616	5616	7088	8544	12555	21732	28029	49828
16	284	426	702	1059	1653	2710	3866	6004	7578	9134	13422	23233	29964	53269
18	301	452	744	1123	1754	2875	4100	6368	8037	9689	14236	24642	31782	56500
20	318	477	784	1184	1848	3030	4322	6713	8472	10213	15006	25975	33501	59556
22	333	500	823	1241	1939	3178	4533	7040	8886	10711	15739	27243	35136	62463
24	348	522	859	1296	2025	3319	4734	7353	9281	11187	16439	28454	36698	65241
26	362	543	894	1349	2108	3455	4928	7653	9660	11644	17110	29616	38197	67905
28	376	564	928	1400	2187	3585	5114	7942	10024	12084	17756	30734	39639	70468
30	389	584	961	1450	2264	3711	5293	8221	10376	12508	18379	31813	41030	72941
32	402	603	992	1497	2338	3833	5467	8491	10716	12918	18982	32856	42375	75333
34	414	621	1023	1543	2410	3951	5635	8752	11046	13316	19566	33867	43680	77652
36	426	639	1052	1588	2480	4065	5798	9006	11366	13702	20133	34849	44946	79903
38	438	657	1081	1631	2548	4177	5957	9253	11678	14077	20685	35804	46178	82093
40	449	674	1109	1674	2614	4285	6112	9493	11981	14443	21222	36734	47377	84225
42	460	691	1137	1715	2679	4391	6263	9727	12277	14799	21746	37642	48547	86305
44	471	707	1163	1755	2742	4494	6410	9956	12566	15148	22258	38527	49690	88336
46	482	723	1190	1795	2803	4595	6554	10180	12849	15488	22758	39393	50806	90322
48	492	738	1215	1834	2864	4694	6695	10399	13125	15821	23248	40241	51899	92264
50	502	754	1240	1871	2923	4791	6833	10613	13396	16148	23727	41070	52969	94167
60	550	825	1359	2050	3202	5248	7486	11626	14674	17689	25992	44990	58025	103155
70	594	892	1468	2214	3458	5669	8085	12558	15850	19106	28074	48595	62674	111420
80	635	953	1569	2367	3697	6060	8644	13425	16944	20425	30013	51950	67001	119113
90	674	1011	1664	2511	3921	6428	9168	14239	17972	21664	31833	55102	71066	126338
100	710	1066	1754	2646	4133	6775	9664	15010	18944	22836	33555	58082	74910	133172
110	745	1118	1840	2776	4335	7106	10136	15742						
120	778	1167	1921	2899	4528	7422	10586	16442						
130	810	1215	2000	3017	4713	7725	11019	17114						
140	841	1261	2075	3131	4891	8017	11435	17760						
150	870	1305	2148	3241	5062	8298	11836	18383						
160	899	1348	2219	3348	5228	8570	12224	18986						
170	926	1389	2287	3451	5389	8834	12600	19570						
180	953	1430	2353	3551	5545	9090	12966	20138						
190	979	1469	2418	3648	5697	9339	13321	20689						
200	1005	1507	2481	3743	5845	9582	13667	21227						
210	1029	1544	2542	3835	5990	9818	14004	21751						
220	1054	1581	2602	3925	6131	10049	14334	22263						
230	1077	1616	2660	4014	6268	10275	14656	22763						
240	1101	1651	2717	4100	6403	10496	14971	23253						
250	1123	1685	2773	4184	6535	10713	15280	23732						
260	1146	1718	2828	4267	6665	10925								
270	1167	1751	2882	4349	6792	11133								
280	1189	1783	2935	4428	6916	11337								
290	1210	1815	2987	4507	7039	11538								
300	1230	1846	3038	4584	7159	11735								
310	1251	1876	3088	4660	7277	11929								
320	1271	1906	3138	4734	7394	12120								
330	1291	1936	3186	4807	7509	12308								
340	1310	1965	3234	4880	7621	12493								
350	1329	1994	3281	4951	7733	12676								
360	1348	2022	3328	5021	7842	12855								
370	1367	2050	3374	5091	7951	13033								
380	1385	2077	3419	5159	8057	13208								
390	1403	2104	3464	5226	8163	13380								
400	1421	2131	3508	5293	8267	13551								
410	1438	2158	3552	5359	8369	13719								

1. Capacity Certified by National Board and Pressure Vessel Inspectors and in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII
2. Capacity in liters per minute of water at 20℃ and at 10% overpressure.
3. The Larger orifice and size more than T orifice also shall be supplied.

10. CAPACITY TABLE

[SC39 series] SI Metric Units, [m3/h], Kd=0.81, Air Capacity

Set Pressure (barg)	Orifice Letter Designation & Area, mm^2					
Areas	C	D	E	F	G	H
API	-	71.0	126.5	198.1	324.5	506.5
Actual	31.6	71.0	126.5	198.1	324.5	506.5
1	36	81	144	225	368	575
2	55	122	218	342	560	874
3	73	164	293	459	751	1173
4	92	206	368	576	943	1472
5	111	248	442	693	1135	1771
6	129	290	517	810	1326	2070
7	148	332	592	927	1518	2369
8	166	374	666	1044	1710	2669
9	185	416	741	1161	1901	2968
10	204	458	816	1278	2093	3267
12	241	542	965	1512	2476	3865
14	278	626	1115	1746	2860	4463
16	316	710	1264	1980	3243	5062
18	353	793	1414	2214	3626	5660
20	390	877	1563	2448	4009	6258
22	428	961	1712	2682	4393	6857
24	465	1045	1862	2916	4776	7455
26	502	1129	2011	3150	5159	8053
28	540	1213	2161	3384	5543	8651
30	577	1297	2310	3618	5926	9250
32	614	1380	2460	3852	6309	9848
34	652	1464	2609	4086	6693	10446
36	689	1548	2758	4320	7076	11045
38	726	1632	2908	4554	7459	11643
40	764	1716	3057	4788	7843	12241
42	801	1800	3207	5022	8226	12839
44	838	1884	3356	5256	8609	13438
46	876	1968	3506	5490	8992	14036
48	913	2051	3655	5724	9376	14634
50	950	2135	3804	5958	9759	15232
60	1137	2555	4551	7128	11676	18224
70	1324	2974	5229	8298	13592	21215
80	1510	3393	6046	9468	15509	24207
90	1697	3813	6793	10638	17425	27198
100	1883	4232	7540	11808	19342	30189
110	2070	4651	8287	12978	21258	33181
120	2257	5071	9034	14148	23175	36172
130	2443	5490	9781	15318	25091	39164
140	2630	5909	10528	16487	27008	42155
150	2817	6329	11275	17657	28924	45146
160	3003	6748	12023	18827	30841	48138
170	3190	7167	12770	19997	32757	51129
180	3377	7587	13517	21167		
190	3563	8006	14264	22337		
200	3750	8425	15011	23507		
210	3936	8844	15758	24677		
220	4123	9264	16505	25847		
230	4310	9683	17252	27017		
240	4496	10102	17999	28187		
250	4683	10522	18747	29357		
260	4870	10941	19494	30527		
270	5056	11360	20241	31697		
280	5243	11780	20988			
290	5429	12199	21735			
300	5616	12618	22482			
310	5803	13038	23229			
320	5989	13457	23976			
330	6176	13876	24723			
340	6363	14296	25471			
350	6549	14715	26218			
360	6736	15134	26965			
370	6923	15554	27712			
380	7109	15973	28459			
390	7296	16392	29206			
400	7482	16812	29953			

1. Capacity in standard cubic meters per hour of air at 15.6℃ and at 10% overpressure.

10. CAPACITY TABLE

[SC39 series] SI Metric Units, [kg/h], Kd=0.81, Steam Capacity

Set Pressure (barg)	Orifice Letter Designation & Area, mm^2					
Areas	C	D	E	F	G	H
API	-	71.0	126.5	198.1	324.5	506.5
Actual	31.6	71.0	126.5	198.1	324.5	506.5
1	28	64	114	178	292	455
2	43	97	173	271	443	692
3	58	130	232	363	595	929
4	73	163	291	456	747	1166
5	88	197	350	549	899	1403
6	102	230	409	641	1050	1640
7	117	263	469	734	1202	1876
8	132	296	528	827	1354	2113
9	147	329	587	919	1506	2350
10	161	363	646	1012	1658	2587
12	191	429	764	1197	1961	3061
14	221	495	883	1382	2265	3535
16	250	562	1001	1568	2568	4009
18	280	628	1119	1753	2872	4482
20	309	695	1238	1938	3175	4956
22	339	761	1356	2124	3479	5430
24	368	828	1474	2309	3782	5904
26	398	894	1593	2494	4086	6378
28	427	960	1711	2680	4389	6851
30	457	1027	1829	2865	4673	7325
32	487	1093	1948	3050	4997	7799
34	516	1160	2066	3236	5300	8273
36	546	1226	2184	3421	5604	8747
38	575	1292	2303	3606	5907	9220
40	605	1359	2421	3792	6211	9694
42	634	1425	2539	3977	6514	10168
44	664	1492	2658	4162	6818	10642
46	693	1558	2776	4347	7121	11115
48	723	1625	2894	4533	7425	11589
50	753	1691	3013	4718	7728	12063

1. Capacity in kilograms per hour of saturated steam at 10% overpressure.

10. CAPACITY TABLE

[SC39 series] SI Metric Units, [L/min.], Kd=0.631, Water Capacity

Set Pressure (barg)	Orifice Letter Designation & Area, mm2					
Areas	C	D	E	F	G	H
API	-	71.0	126.5	198.1	324.5	506.5
Actual	31.6	71.0	126.5	198.1	324.5	506.5
1	19	42	75	117	192	300
2	26	59	106	166	272	424
3	32	73	130	203	333	520
4	37	84	150	235	384	600
5	42	94	168	262	430	671
6	46	103	183	287	471	735
7	50	111	198	310	508	794
8	53	119	212	332	544	848
9	56	126	225	352	576	900
10	59	133	237	371	608	949
12	65	146	260	406	666	1039
14	70	157	280	439	719	1122
16	75	168	300	469	769	1200
18	79	178	318	498	815	1273
20	84	188	335	525	859	1341
22	88	197	351	550	901	1407
24	92	206	357	575	941	1469
26	95	214	382	598	980	1529
28	99	222	396	621	1017	1587
30	102	230	410	643	1053	1643
32	106	238	424	664	1087	1697
34	109	245	437	684	1121	1749
36	112	252	449	704	1153	1800
38	115	259	462	723	1185	1849
40	118	266	474	742	1215	1897
42	121	272	485	760	1245	1944
44	124	279	497	778	1275	1990
46	127	285	508	796	1303	2034
48	130	291	519	813	1331	2078
50	132	297	530	830	1359	2121
60	145	326	580	909	1489	2323
70	157	352	627	982	1608	2510
80	167	376	670	1049	1719	2683
90	178	399	711	1113	1823	2846
100	187	420	749	1173	1922	2999
110	196	441	786	1230	2015	3146
120	205	461	821	1285	2105	3286
130	213	479	854	1338	2191	3420
140	221	497	886	1388	2274	3549
150	229	515	917	1437	2354	3674
160	237	532	948	1484	2431	3794
170	244	548	977	1530	2506	3911
180	251	564	1005	1574		
190	258	580	1033	1617		
200	265	595	1059	1659		
210	271	609	1086	1700		
220	278	624	1111	1740		
230	284	638	1136	1779		
240	290	651	1161	1817		
250	296	665	1184	1855		
260	302	678	1208	1892		
270	307	691	1231	1928		
280	313	704	1254			
290	319	716	1276			
300	324	728	1298			
310	329	740	1319			
320	335	752	1340			
330	340	764	1361			
340	345	775	1381			
350	350	787	1401			
360	355	798	1421			
370	360	809	1441			
380	365	820	1460			
390	370	830	1479			
400	374	841	1498			

Mt.H CONTROL VALVES PRODUCTS

[HSP-OVT SERIES]

1. General

Mt.H Pilot Operated Safety Relief Valves have been designed and manufactured in accordance with the ISO 9001 quality system and international standard and code. Pilot operated safety relief valves have been tested and examined, using sophisticated measuring instruments and facilities under the low temperature circumstance. In particular, Pilot operated safety valves are fully verified and evidenced through international evaluation bodies. Pilot operated safety relief valves can be used widely two ultimate conditions, very low temperature and/or very low pressure service, having cryogenic materials which have durable characteristic. Specially, This valves are designed for use with tanks of ultra low temperature liquefied gases such as LNG/LPG (Land and Ocean cargo tank and insulation space).

2. Features and Advantage

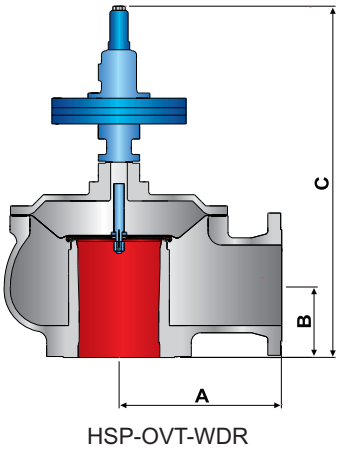
- Compact and simple design for small installation space
- Full lift of disc for large discharge capacity
- Discharge Coefficient (Kd) certified by National Measurement Test Lab.
- Compact and simple design for small installation space
- Type Approval obtained by the Ship Classification Society

3.Standard Dimensions (mm)

Model: HSP-OVT-WDR*			
inch	A	B	C
2X2	150	105	565
3X3	180	115	597
4X4	250	142	750
6X6	315	140	750
8X8	400	200	888
10X10	500	230	960

Model: HSP-OVT-DR*			
inch	A	B	C
2X3	150	105	580
3X4	180	115	620
4X6	250	140	768
6X8	315	175	820
8X10	400	200	910
10X12	500	230	980
12X16	560	280	1090
14X18	630	310	1170

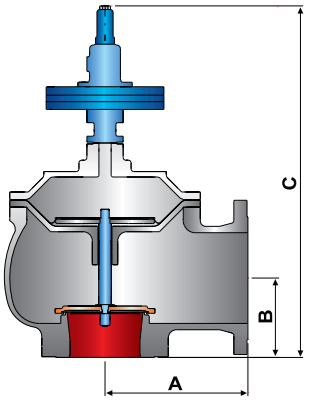
* -WDR: without retainer type
* -DR: with retainer type
* Flange Rating(inlet x outlet) : 150 lbs x 150 lbs



HSP-OVT-WDR

4. Specification

Contents	Technical Specification
Pressure Range kPa (bar)	'- HSP-OVT-WDR : 0.01 ~ 0.1bar - HSP-OVT- DR : 0.04 ~ 1.5bar
Temp. Range (℃)	'-196 ~ 80℃
Service	• Natural gas & Petroleum Drilling • Low Pressure Storage • Receiving Terminals • LNG/LPG Carrier • LEG Storage
Applied Gas	LNG(CH_4) / LPG / O_2/ N_2 / CO_2 / Etc.



HSP-OVT-DR

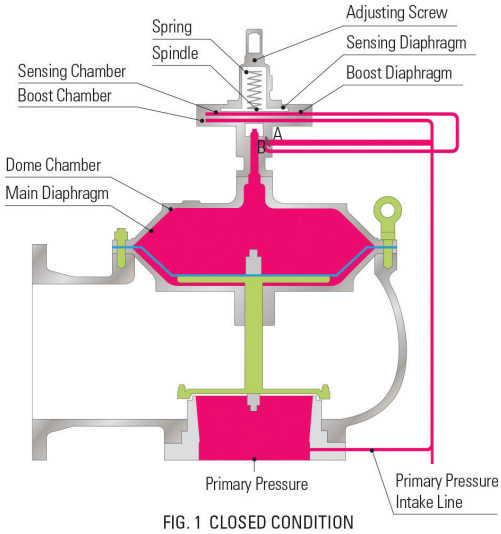


FIG. 1 CLOSED CONDITION

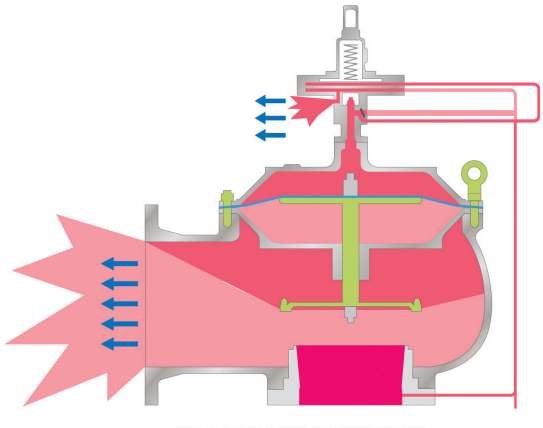


FIG. 2 OPERATION OF MAIN VALVE

5. Operation Principle

1. CLOSED CONDITION (FIG. 1)

Pressure is supplied to the dome chamber of the main valve from the pressure intake line of the primary side through the adjusting needle (A) and the fixed needle (B), and then to the sensing chamber from downstream of the adjusting needle (A). Furthermore, pressure is also directly introduced to the boost chamber from the pressure intake line in order to always equalize it with the system pressure. In this condition, the system pressure (PO), the dome pressure (PD), the sensing pressure (PS) and the boost pressure (PB) are all the same, as expressed in the following formula.

$$PO=PD=PS=PB$$

Since the main valve is so designed that the pressure receiving area of the piston (AD) is larger than that of the disc (AO), the disc of the main valve is firmly pressed against the nozzle seat by the load obtained by (AD-AO) x PO. In the pilot valve, the sensing chamber and the boost chamber are balanced in pressure and the force which acts to open the pilot valve is the one obtained by multiplying the pressure receiving area of the sensing diaphragm (AS) with PS. The following relation is maintained for the pilot valve.

$$SpringLoadF > ASxPS$$

adjusting needle (A) and the fixed needle (B) due to the full lift of the pilot valve, the dome chamber pressure drops. Owing to this pressure drop of the dome chamber, the disc of the main valve is lifted by the system pressure, attaining a full lift at the specified pressure.

2. OPERATION OF MAIN VALVE (FIG. 2)

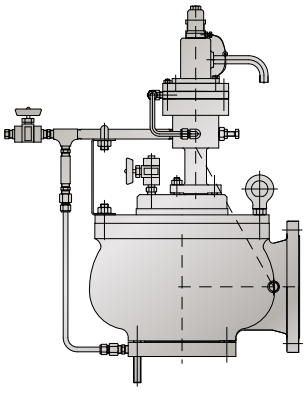
Since the flow rate of fluid discharged from the pilot valve is larger than that of fluid flowing into the dome chamber through the adjusting needle (A) and the fixed needle (B) due to the full lift of the pilot valve, the dome chamber pressure drops. Owing to this pressure drop of the dome cham- ber, the disc of the main valve is lifted by the system pressure, attaining a full lift at the specified pressure.

PD : Main valve dome pressure
PS : Pilot sensing pressure
PB : Pilot boost pressure
AO : Pressure receiving area of main valve disc
AD : Pressure receiving area of main valve dome
AS : Pressure receiving area of sensing diaphragm
AB : Pressure receiving area of boost diaphragm

[SP35 SERIES]

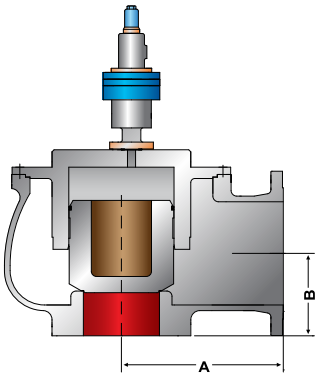
1. General

Pilot Operated Safety Relief Valve have been designed and manufactured in accordance with the ISO 9001 quality system and international standard and code. Pilot operated safety relief valves have tested and examined, using sophisticated measuring instruments and facilities under the low temperature circumstance. In particular, Pilot operated safety valves are fully verified and evidenced through international evaluation bodies. Pilot operated safety valves can be used widely two ultimate conditions, namely, very low temperature and/or Middle Pressure service, having cryogenic materials which have durable characteristic.



2. Features and Advantage

- Compact and simple design for small installation space.
- Full lift of disc for large discharge capacity.
- Discharge Coefficient (Kd) certified by National Measurement Test Lab.
- Type Approval obtained by the Ship Classification Society.



3.Standard Dimensions (mm)

Rating	150 X 150 LBS		300 X 150 LBS	
inch	A	B	A	B
2X3	150	113	150	113
3X4	180	123	180	123
4X6	250	148	250	148
6X8	315	183	315	188
8X10	400	203	400	208

4. Specification

Contents	Technical Specification
Pressure Range	1 ~ 20bar
Temperature Range(℃)	-196 ~ 80℃
Service	• Natural gas & Petroleum Drilling • Middle Pressure Stroage • Receiving Terminals • LNG/LPG Ship Carriers • LEG Storage
Applied Gas	LNG(CH_4) / LPG / O_2 / N_2 / CO_2 /etc.

Mt.H CONTROL VALVES PRODUCTS

[HSF-FCA SERIES]

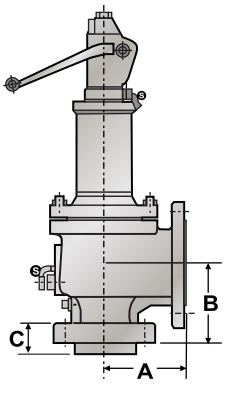
1. General

Mt.H Spring Loaded Safety Relief Valves have been designed and manufactured in accordance with the ISO 9001 quality system and international standard and code. Spring loaded safety relief valves have been tested and examined, using sophisticated measuring instruments and facilities under the low temperature circumstance. In particular, Spring loaded safety relief valves are fully verified and evidenced through international evaluation bodies. Spring loaded safety relief valves can be used widely from ambient temperature to very low temperature(cryogenic) pressure service, having cryogenic materials which have durable characteristic. Specially, This valves are designed for use with pipe line of ultra low temperature liquefied gas such as LNG/LPG.

2. Features and Advantage

- Compact and simple design for small installation area
- Smart concept and idea for easy maintenance, adjustment, and operation
- Full lift of disc for large discharge capacity
- Fully zero leakage and small blow-down for min. loss of medium
- Discharge coefficient(Kd) certified by national measurement Testing Lab.
- TYPE APPROVAL obtained by classification society

Standard Dimensions and Weight



Size (inch)	ANSI Flange Rating (LBS)		Dimensions (mm)			Weight (kg)
INLETxOUTLET	INLET	OUTLET	A	B	C	
3/4x1	150	150	96	87	25	13.2
1x2	150	150	114	98	30	15.5
1.5x2	150	150	121	124	30	20.5
1.5x2.5	150	150	121	124	30	23.0
1.5x3	150	150	124	130	34	26.5
2x3	150	150	124	137	45	34.0
3x4	150	150	165	169	39	57.0
4x6	150	150	229	181	50	68.0

The another size, flange rating also can supply to our customers

Specification

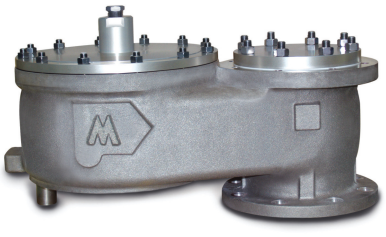
Contents	Technical Specification
Pressure Range, MPa (bar)	0.1 to 1.0 (1~10), Max, 330bar
Temp. Range (℃)	-196 to +125
Service	• Natural gas & Petroleum Drilling pipe • Petroleum Refining pipe • Receiving Terminals pipe • Liquefied Gas Storage pipe • LNG/LPG Carrier pipe • LEG Storage pipe • Petroleum Refining Plants and Other Chemical Plants pipe

Mt.H CONTROL VALVES PRODUCTS

[HVB-DW SERIES]

1. General

Mt.H Weight Loaded Vacuum Breakers have been designed and manufactured in accordance with the ISO 9001 quality system and international standard and code. Weight loaded vacuum breakers have been tested and examined, using sophisticated measuring instruments and facilities. Weight loaded vacuum breakers have been designed on storage tank damages and other process vessels or system to prevent structural damage due to excess internal vacuum. Specially, Weight loaded vacuum breakers can be used widely from negative pressure to positive pressure depend on storage tanks conditions to vacuum relief.

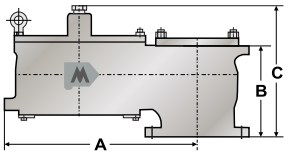


2. Features and Advantage

- Compact and simple design for small installation area
- Smart concept and construction for easy maintenance and operation
- Full lift of disc for large discharge capacity
- Fully zero leakage for min. loss of medium
- Easy vacuum set adjustments

Standard Dimensions and Weight

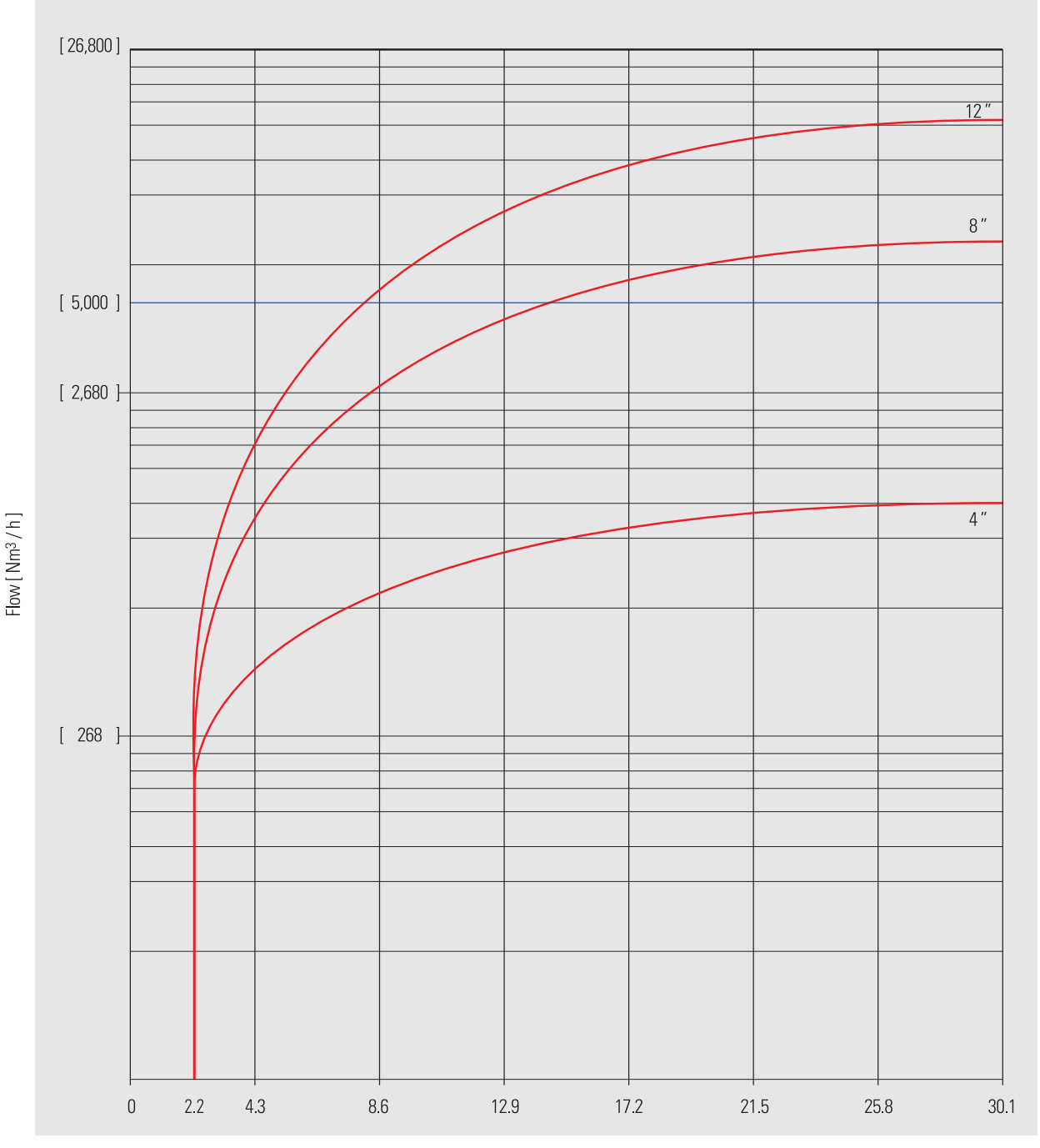
Size (inch)	ANSI Flange Rating (LBS)	Dimensions (mm)			Weight (kg)
INLET	INLET	A	B	C	
4(inch)	150	419	217	297	22
8(inch)	150	640	305	444	55
12(inch)	150	889	415	533	115



Specification

Contents	Technical Specification		
Standard Vacuum Setting	-2.2mbarg [$^1/_2$ oz/in^2]		
Vacuum Set Pressure Range	-2.2 to -6.6mbrg		
Maximum Positive Pressure	4 inch 5.86barg [85psig]	8 inch 4.48barg [65psig]	12 inch 3.03barg [44psig]
Temp. Range	Ambient(0 to +80℃)		
Service	Air (Vapor)		

Capacity Curve



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